# NON-NATIVE SPECIES IN ANTARCTICA

## A REVIEW OF HOW THE ANTARTIC TREATY PARTIES ARE RESPONDING TO THE ISSUE THROUGH THE ANTARCTIC TREATY CONSULTATIVE MEETINGS.


*Figure 1:* Antarctica and the Southern Ocean that surrounds it.

*Credit: Ross Sea Region 2001: A State of the Environment Report for the Ross Sea Region of Antarctica*


**LITERATURE REVIEW**
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*"The protection of the Antarctic environment and dependent and associated ecosystems and the intrinsic value of Antarctica, including its wilderness and aesthetic values and its value as an area for the conduct of scientific research, in particular research essential to understanding the global environment, shall be fundamental considerations in the planning and conduct of all activities in the Antarctic Treaty area"*

**Protocol on Environmental Protection to the Treaty. Article 3: Environmental Principles**

**INTRODUCTION**

Biological invasions through the introduction of non-native species (NNS) such as microbes, fungi, plants and animals are considered globally as one of the most significant threats to biodiversity (McKinney & Lockwood 1999 cited in Frenot et al. 2005). Almost every continent and ecosystem type on earth has been affected by NNS often resulting in irreversible changes to the structure and functioning of ecosystems.

Antarctica, with no indigenous population, remained free of human visitation until approximately two centuries ago. Isolated from the rest of the world through its climate and geography, the Continent, which contains less than 2% ice free areas (Potter 2006), has developed a series of simple (some of which have been described as the simplest on the planet [Convey, 2007]), yet interdependent eco-systems and is one of the last continents where biogeographic boundaries still exist (De Poorter & Gilbert et al. 2006).

Research to date indicates the vast majority of the Continent has escaped biological invasions. However, increasing human visitation and activity both to, from and within, the Continent (predominantly by national Antarctic programmes and tourists) combined with current climatic trends means there is an increasing awareness by Treaty Parties of the risk of NNS unintentionally being introduced and becoming established on the Continent. Another significant risk recently identified by Treaty Parties is the impacts of intra-continental contamination whereby native species have the potential to be unintentionally transferred across natural biogeography boundaries within the Continent into ecosystems where they do not naturally exist (De Poorter & Gilbert et al. 2006)

This paper is a review of how Antarctic Treaty Parties have addressed the issue of the [unintentional] introduction of NNS within the Treaty Area through Antarctic Treaty Consultative Meetings over the past decade. It also includes a case study of how a Treaty Party member, the Australian Antarctic Division, is addressing the issue as part of their obligations under the Treaty.

It is limited to a review of NNS being unintentionally introduced to the Antarctic Continent through human activity but does not address the issue of unintentional introduction of NNS to the marine environment of the Treaty Area (Southern Ocean).

**Evidence of Biological Invasions through NNS**

The World Conservation Union (IUCN) defines non-native species as *"species occurring by human agency in an ecological area where it is not native" (De Poorter 2007).* Although there is detailed research and evidence of the significant damage caused to the eco-systems of the sub Antarctic islands through the introduction of NNS (Frenot et al. 2005, Bergstrom & Chown 1999) there is limited research on the subject in regards to the Treaty Area. In 2005 Frenot et al. published the first *"major summary of knowledge of alien taxa for southern, high-latitude sub-Antarctic and Antarctic regions".* Despite noting that a comprehensive baseline biological survey for the Continent has yet to be undertaken, the paper concluded:

- The biota of some of the Continent's ice-free areas already include alien taxa.
- The recorded impacts of NNS have ranged from negligible and transient to persistent but with limited distribution through to aggressive invasives resulting in significant consequences.

- The introduction of NNS, together with the possibility of existing persistent species becoming major invasives, while lower than elsewhere, is a significant risk.
- Current climatic trends will enhance the ability of non-native species to survive in the Antarctic.
- Given the increase in human activity on the Continent rigorous biosecurity measures need to be implemented.

From the limited research undertaken, it appears that the vast majority of Antarctica's terrestrial ecosystems (to date) appear to be relatively unaffected by NNS. Convey (2007) states as few as five non-native plants and animals have been proven to have established within the Treaty Area, none of which can, as yet, be classified as invasive. However, both Convey (2007) and Frenot et al. (2005) acknowledge the need for a comprehensive baseline biological survey to be undertaken, ongoing monitoring and the introduction of practical measures to minimize and mitigate the risks associated with the introduction of NNS.

There is also an increasing awareness amongst Treaty Parties of the potential risks associated with intra-continental contamination which has the potential to not only impact on local ecosystems but also affect the associated scientific values of the sites. This appears to be an issue which has only recently begun to be discussed at Antarctic Treaty Consultative Meetings (ATCM) and while identified as a potential risk to the Continent's ecosystems it appears little scientific research has been undertaken.

**ADDRESSING ENVIRONMENTAL AND CONSERVATION ISSUES THROUGH THE TREATY SYSTEM**

The Antarctic Treaty is the founding document that governs human activity in Antarctica. It is supported by five legal instruments (four free-standing agreements and an environmental protocol) and together these provide the legal framework for the protection of Antarctica. In addition to being bound by International Law Treaty Parties are obligated to develop and apply legislation at a domestic level to implement their obligations under the Treaty and its associated instruments.

From relatively early on the Treaty System has recognised the scientific values of the Continent and the importance of the protection of the native fauna and flora. While the Treaty itself does not specifically address environment and conservation issues, it does acknowledge the importance of the preservation and conservation of Antarctica's "*living resources*" (Article IX). However, environmental and conservation issues began to be addressed soon after the Treaty entered into force with the adoption of the Agreed Measures for the Conservation of Antarctic Fauna and Flora in 1964. The Agreed Measures acknowledged NNS by addressing the management of the "intentional" introduction of NNS for scientific purposes through a permitting system and disposal requirements. The Agreed Measures were effectively replaced in 1991 by the Protocol on Environmental Protection to the Antarctic Treaty with many of the principles outlined in the Measures transferred to, and expanded on, in the Protocol.

The Protocol acknowledges the scientific value of the Continent as essential to our understanding of the global environment (Article 3) and establishes the Committee for the Environmental Protection (Article 11) to provide advice to the ATS on the implementation of the Protocol. The Protocol introduces environmental principles for the conduct of all activities by Parties to ensure they avoid *"detrimental changes in the distribution, abundance or productivity of species of populations of fauna and flora*" (Article 3) and activities considered to have more than a minor or transitory impact on the environment are subject to an Environmental Impact Assessment (Annex 1). Article 4 off Annex II of the Protocol addresses the "intentional" introduction of non-native species, parasites and diseases for scientific purposes by providing for a permitting system and disposal requirements and requires precautions be taken to prevent the introduction of non-native micro-organisms (eg viruses, bacteria, parasites, yeasts, fungi). Procedures to specifically prevent the introduction of micro-organisms are addressed in Appendix C of Appendices to Annex II of the Protocol which prohibits the introduction of living birds and requires any unused dressed poultry taken into the Treaty area be removed to

eliminate risks to the native flora and fauna. The Appendix also requires the importation of non-sterile soil be avoided to the maximum extent possible.

In summary, although the "unintentional" introduction of NNS is not directly addressed, the obligation for Treaty Parties to address the issue can be inferred from a number of the Protocol's Articles and Annexes.

**RAISING THE ISSUE THROUGH THE CEP AND ATCM**

Although the risks posed by NNS were identified at the inaugural meeting of the Scientific Committee for Antarctic Research (SCAR) Biology Working Group (Murray, 1964 cited by AAD website) it appears the issue has received little attention until the 1990s. Since 1997 the issue has increasingly been raised through Antarctic Treaty Consultative Meetings (ATCM) with a number of Working Papers (WP) and Information Papers (IP) being presented with papers predominantly submitted by Australia and New Zealand. The IUCN, which holds invited "Expert Status" at ATCMs, has also been active since the 1990's, repeatedly offering to assist to develop measures to both prevent and mitigate the effects of NNS. The International Association of Antarctic Tour Operators (IAATO), the self-regulating voluntary body for tourist operators in the Antarctic area while holding invited "Expert Status" at ATCMs, do not appear to have been active in addressing the issue at ATCM level[1].

As a result of a number of papers presented to ATCM on the issue in 1997/98 Australia hosted a workshop on "*Diseases of Antarctic Wildlife*" and presented the findings and recommendations to CEPII ATCM XXIII (1999). ATCM XXIII/WP32 noted the increasing risk of disease being introduced into Antarctic wildlife as a result of the increasing number of people travelling to, and within, Antarctica and made a series of what are effectively "biosecurity" recommendations (i.e. risk assessment, prevention, mitigation and monitoring and response) to address the issue of NNS. The CEP requested that an open-ended contact group be formed and in 2001 the findings were presented to CEPIV as ATCM XXIV/WP10 & WP11: Review and Risk Assessment and Practical Measures to Diminish Risk. The minutes of the CEP Final Report IV acknowledges the WPs but no action appears to be taken at the time to implement the recommendations.

Australia continued to be active in raising the issue of NNS and biosecurity at ATCMs. In 2004 it presented ATCM XXVII/IP71 outlining its quarantine practices in regards to the Antarctic and in 2005 presented to CEP VIII ATCM XXVIII/WP28 a recommendation that the CEP endorse the formation of an intercessional contact group to assess the threat to *the "Antarctic environment from the introduction and spread of alien organisms and disease*". The CEP Final Report VIII acknowledges the WP and New Zealand indicated that it would be prepared to host a workshop on the issue of NNS.

Although tourists to the Continent are one of the two main vectors (together with national Antarctic programmes) for the potential introduction of NNS there appears to be little information presented to recent ATCMs on the issue. There is a brief reference to protecting wildlife in the *"Guidance for Visitors to the Antarctic"* adopted at ATCM XVIII-I which recommends visitors do not bring non-native plants or animals into the Treaty Area (IAATO website). In 2004, Australia, as a contribution to the Antarctic Treaty Meeting of Experts (ATME) on Antarctic Tourism and Non-Government Activities, prepared a paper regarding the establishment of effective quarantine controls for tourism and non-government activities. However, the ATME "had insufficient time" to consider the issue. As a result Australia presented ATCM XXVII/WP21(Rev 1) in which it recommends the CEP assess the risks associated with tourist activities and non-government organisations and develop proposals for the establishment of effective Antarctic quarantine controls. The CEP Final Report VII acknowledges the WP but does not recommend any action.

[1] IAATO has produced internal operational guidelines for IAATO operators "Boot, Clothing and Equipment Decontamination Guidelines" (IAATO Website)

New Zealand's involvement with NNS at ATCM level has been relatively recent. In 2006 New Zealand (under the auspices of the CEP) hosted a "Non Native Species in the Antarctic" workshop and presented the findings and recommendations as ATCM XXIX/WP13 & IP46. WP13 effectively reiterated the findings of the 1998 workshop in that biosecurity measures (i.e. risk assessment, prevention, mitigation and monitoring) are urgently needed to manage the issue of NNS. CEP Final Report IX "strongly supported" the recommendations of WP13 which included:

a) *"The issue of NNS should be given the highest priority …* and *that the CEP should take the lead on this"*

b) *"Dedicated research … of, inter alia, existing biological and genetic diversity, species distribution and biogeographic zones…"*

c) *"To the extent possible, non-native species issues should be built into existing procedures…notably EIA procedures".*

d) *"A set of…procedures should be developed, aimed at all operators in the Antarctic, based on a "Prevention, Surveillance, Response" approach.*

The increasing importance Treaty Parties are placing on the issue of NNS is also evidenced by the research beginning to be undertaken by organisations which hold invited "Observer" status at ATCMs such as the Scientific Committee on Antarctic Research (SCAR) and the Council of Managers National Antarctic Programmes (COMNAP). In 2007 SCAR presented a joint paper with Australia. ATCMXXX/IP49 outlines an International Polar Year project to assess the pathways and vectors for NNS and SCAR's Life Sciences Standing Scientific Group (LSSSG) is currently developing a Code of Conduct for Field Work which begins to address not only the introduction of NNS to the Continent but the issue of intra-continental contamination (SCAR website). In 2006 the Antarctic Environmental Officers Network (AEON), a group of COMNAP undertook a survey of national programme operators to assess what procedures were in place to minimise the introduction of NNS (AEON Survey Results 2006). Responses were received from almost 70% of programmes that operates bases on the Continent. Only one operator did not have some form of procedures in place.

2007 culminated in five papers directly related to NNS being presented. This included United Kingdom's ATCMXXX/WP21 which highlighted the issue of intra-continental contamination within the context of an Antarctic Specially Protected Area of unique scientific value and New Zealand's ATCM/WP15 presented the CEP's provisional five year workplan. It lists the issue of NNS amongst its highest priorities.

**AUSTRALIAN ANTARCTIC DIVISION**

Given Australia is a signatory to the Treaty, has taken a leading role in environmental protection since the inception of the ATS, and led the issue of NNS at Treaty meetings, this portion of the paper includes a case study of how the Australian Antarctic Division (AAD) is addressing the issues of NNS. It should be noted that the study is not meant to be a critical review of what measures they have implemented, rather it is included to give an example and context as to what is required of Treaty Parties if they intend to address the issue of NNS and biosecurity in Antarctica.

Australia's Antarctic Territorial (ATT) claim is administered by the Australian Antarctic Division (AAD) and is located in the port city of Hobart, Tasmania. AAD operates a "national institute" approach in that it delivers both the science research and the logistics needs to support the scientists. AAD administers three permanent research stations on the Continent (Mawson, Davis and Casey). During the peak summer season AAD deploys more than 400 personnel to its continental bases by ship (Australia in Antarctica 2006). Aircraft use to date, with the exception of one inter-continental flight by two small aircraft each season, has been limited to operating between AAD's continental based stations/field research sites and ship-to-shore (Potter 2006).

However, this season (2007/08) final trials are underway which will see AAD establish regular, intercontinental flights from Hobart to Casey Station (Australian Antarctic Magazine, 2006).

**SO WHAT IS AUSTRALIA DOING?**

Quarantine provisions to protect the AAT through domestic legislation is provided for through Australia's Antarctic Treaty (Environmental Protection) Act 1980 (EPA), which regulates Australia's activities in the Treaty Area. As part of its commitment to the Antarctic environment, the AAD has implemented an internationally accredited Environmental Management System (ISO 14001) (EMS) as a way of documenting, monitoring and improving its environmental performance (AAD Environmental Management System Manual 2007). Administratively the issue of NNS is considered very early on in AAD's planning stages for activities on the Continent and is taken into consideration when environmental impact assessments (EIA) are being evaluated and conditions are attached to permits as necessary (Potter 2007).

As a result of its strong administration framework (such as the EMS and a department dedicated to policy development) the AAD has developed a "Quarantine Management Statement" which outlines Australia's quarantine goals and objectives for Antarctica together with a "Quarantine Management System" (QMS) to implement them. The AAD has entered into a Memorandum of Understanding with Tasmania's quarantine body, Quarantine Tasmania (ATCMXXVII/IP71) to assist with quarantine management.

The AAD utilises the existing port facilities in Hobart and has dedicated shipside facilities (accredited as "Class One" sea and airfreight depot by Australia's national quarantine authority) for all cargo destined for the Continent. Cargo, and the containers they are stored in, are regularly inspected and treated as required and "high-risk" items such as machinery automatically undergo treatment. There are restrictions in place for the use of wood and personnel traveling to Antarctica must declare any goods that may be considered a potential threat. Quarantine detector dogs are used to screen mail and random inspection of expeditioners' personal luggage is undertaken by quarantine officers and dogs (Potter 2006).

All ships are subject to a "Clean Ship" inspection by Quarantine Tasmania prior to departure and if stopping at the sub Antarctic islands of Heard and McDonald[2] then a full, manual quarantine inspection of all gear (including cabin luggage, unaccompanied personal effects and scientific equipment) is undertaken. Before disembarkation from ships, compulsory procedures include bootwashing, inspecting and cleaning of outer-gear including clothing, back-packs, tripods and tool boxes. These procedures are repeated for every landing to avoid intra-continental contamination (Potter 2006).

Pre-departure cleaning and inspections are carried out for the two small aircraft which undertake the one intercontinental flight made each year and protocols for the inspection and cleaning of cargo are adapted for the aircraft used for intra-continental/field station support. Additional measures include fixed wing aircraft being disinfected using a perethrin-based spray. Given most intra-continental flights are made from snow or ice runways limited procedures have been developed to address the risk of intra-continental contamination. Aircraft movements (such as helicopters landing on multiple ice-free sites) identified as posing a risk are generally addressed at the EIA stage and conditions attached to the permit as required. With regular inter-continental flights scheduled to begin shortly, further quarantine strategies are currently being developed (Potter 2006).

[2] An Australian external territory administered by the AAD on behalf of the Australian Government. Inscribed on the World Heritage List and designated as an Australian Commonwealth Marine Reserve. As a result of its status it is subject to additional quarantine controls.

All commercial suppliers of goods and services bound for the Continent are bound by AAD's environmental policies and all food supplied is subject to national procedures. Inspection of fresh produce is undertaken to internationally recognized standards ("600 units two percent sample standard") and some foods are either prohibited or restricted to use on ships and stations (Potter 2006).

In the field faeces, urine and greywater are generally returned to the nearest station. There are some exceptions to this where the length of stay or size of the field party needs to be considered and these issues are generally dealt with at the environmental impact assessment stage (AAD Field & Field Waste Management Guide 2007/08). Biological sewage treatment plants have been installed at all three stations and the resulting sludge returned to Australia. The UV sterilisation of the effluent is currently being trialed to ensure that no harmful organisms are released into the environment (Potter 2006).

All kitchen waste generated at the stations is incinerated and the ash shipped to Australia. Handling (unless permitted) and feeding of wildlife is prohibited. Hydroponic units are located on all continental bases and are subject to regular monitoring, cleaning and filtering of wastewater as well as restrictions on what may be grown and plant waste matter is incinerated (Potter 2006).

The AAD's Environmental Policy identifies education and training as key tool in protecting the environment and as a result personnel must undergo briefing and training on quarantine issues prior to departure. Procedures, policies and legislation are clearly (and repeatedly) detailed in expeditioners' pre-departure documentation. Other tools available include "Alien Invertebrate Collection Kits" for collecting any NNS found in Antarctica for later identification and an intranet is available to report any environmental issues (AAD Expeditioners' Handbook 2007).

As a result of extensive experience administering biosecurity at a domestic level, together with the legislation and management strategies developed to protect the sub Antarctic islands such as Macquarie (which has been subjected to the devastating effects of NNS) Australia appears to have well developed quarantine systems in place in relation to Australia's activities in the Antarctic.

It is clear, from the literature reviewed, Australia has a long-term commitment to protecting the Antarctic environment from NNS and has developed a strong administrative framework to work within. Strong domestic legislation which specifically deals with quarantine issues for Antarctica (EPA, 1980), operating a "national institute" model which has resulted in strong interdepartmental relationships, good intergovernmental relationships (such as Quarantine Tasmania), dedicated science research into the "*Impacts of Human Activities in Antarctica"* (including NNS) and a dedicated policy department which has resulted in clear policy statements and guidelines are all evidence of Australia's commitment to the issue. The implementation of the internationally accredited Environmental Management System means policies and procedures in relation to environmental practices are continually monitored, reviewed and improved.

**CONCLUSION**

It is evident from the literature reviewed that some Treaty Parties acknowledge NNS both as a major environmental threat and its potential to impact on the scientific value of the Continent. Australia and New Zealand have dominated the submission of papers on the issue of NNS. However, it is unclear from the literature reviewed what the opinion of the majority of the Treaty Parties is.

If Treaty Parties do agree to address the issue of NNS and biosecurity, then one of the biggest challenges facing Treaty Parties is the need for not only agreement but "buy in" from all participants. The successful implementation of any biosecurity programme is dependent on the participation and buy-in by **all** parties involved and the level of success is only as good as the measures put in place by its weakest participant. The issue is further challenged by the current structure of the ATS which leaves it to individual Treaty Parties to interpret, develop and apply legislation at a domestic level to implement their obligations under the Treaty

and its associated instruments. This in turn raises further questions as to whether the issue can be adequately dealt with within existing Treaty documents (e.g. Annex 1 Environmental Initial Assessments).

Issues are also raised as to how to ensure non Treaty members such as non-government organisations, tourists and other non treaty parties comply with biosecurity measures. This is another challenge that needs to be considered, particularly given there may be cost implications and pull on resources if Governments are required to carry out quarantine control and monitoring.

The lack of a comprehensive baseline biological survey appears to be another major challenge given good scientific data underpins the development and implementation of effective biosecurity strategies (O'Neil 2006 cited in De Poorter & Gilbert et al. 2006). While the CEP has agreed to take the lead on the issue it appears SCAR would be the natural organisation to co-ordinate the study. This again requires buy-in from all parties and raises complex issues around not only how to fund the resources required to co-ordinate the studies and undertake the research but deciding where, when and who carries out the studies and monitoring. It also raises the issue of the potential to place additional stress placed on national operators' logistics. The study may also conflict or compete with some Governments' existing research priorities and it may be difficult to convince some parties as to the importance of the study given some might take a short term view and deem there to be no direct "benefits" for their country resulting from the study.

Time is also an issue. While biosecurity measures in regards to prevention, mitigation and response could be implemented reasonably quickly, the co-ordination and implementation of the survey could (as with any Antarctic research) take a number of years to co-ordinate and implement. This also applies should any changes/additions be required to existing Antarctic Treaty System instruments such as the Protocol.

It is also unclear if Treaty Parties are aware of the commitment required and cost implications of implementing long-term biosecurity measures.

Despite the challenges Treaty Parties are in a unique opportunity to address the issue. With very few NNS species established on the Continent, together with relatively easily identifiable entry routes (there are only five acknowledged global gateways to the Continent) and a legal framework in place to address the issue, the Treaty Parties are in a position to be proactive and address the potential threat before it becomes an even greater threat.

Some would consider how Antarctic Treaty parties respond to this latest threat as an indicator as to how committed Antarctic Treaty parties are not only to the environmental protection of the Continent but to the concept of Antarctica as a Continent for (peace) and science.

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